CALIFORNIA
ENERGY
COMMISSION

2001 AB 970 RESIDENTIAL ENERGY CONSERVATION MANUAL SUPPLEMENT

Certified by the Commission
January 3, 2001

COMMISSION CERTIFIED MANUAL

December 2000
P400-01-002S
Revised January 4, 2001

Gray Davis, *Governor*

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Assembly Bill 970 Building Energy Efficiency Standards

2001 AB 970
Residential Energy Conservation
Manual Supplement

Energy Commission Publication No. P 400-01-002S

This 2001 AB 970 Residential Energy Conservation Manual Supplement includes descriptions and clarifications of the 2001 AB 970 Energy Efficiency Standards for Residential Buildings. This Manual is intended as a supplement to the July 1999 Residential Manual (P400-98-002). This manual supplement was certified at the Energy Commission's January 3, 2001 Business Meeting. The manual supplement represents revisions to the Title 24 Building Energy Efficiency Standards (California Code of Regulations, Title 24, Part 6 and the Administrative Regulations, Title 24, Part 1.)

January 4, 2001

RESIDENTIAL

Introduction

On September 6, 2000 Governor Gray Davis signed into law Assembly Bill (AB) 970, the California Energy Security and Reliability Act, to avoid electricity supply failures and extremely high electricity bills throughout California. AB 970 required the California Energy Commission (Commission) to adopt new emergency energy efficiency standards for residential and nonresidential buildings within 120 days. The AB 970 mandate for these emergency standards is to ensure maximum feasible reductions in wasteful, uneconomic, inefficient, or unnecessary consumption of electricity.

The new 2001 AB 970 Energy Efficiency Standards for Residential and Nonresidential Buildings (Standards) require applicable buildings to be more energy efficient than did the 1998 Standards.

This *2001 Residential Energy Conservation Manual Supplement* describes the changes to the 1998 Residential Standards and provides information to help the design, construction and enforcement community to comply with these important changes. The *Residential Manual* dated July 1999, publication number P400-98-002, is referenced for use except for the topics addressed herein or otherwise noted. P400-98-002 may be obtained in CD-ROM format or may be downloaded in PDF format from the Commission website:

http://www.energy.ca.gov/title24

This supplement is intended to be used in conjunction with the *2001 AB 970 Building Energy Efficiency Standards*, and therefore, is organized in the order that the changes appear in the Standards. The reader should recognize that the most important changes from an energy perspective are the new requirements in Alternative Component Package D, which establish a new Standard Design for the Performance Standards, the new Mandatory Duct Construction requirements, and the Field Verification requirements. The *2001 Building Energy Efficiency Standards* may be downloaded in PDF format from the Commission website:

http://energy.ca.gov/ab970_standards

Effective Date

The effective date of the AB 970 Building Energy Efficiency Standards amendments shall be June 1, 2001.

Exception:

Building energy efficiency standards compliance documentation submitted prior to June 1, 2001, using the Multiple Orientation Alternative of Section 151(c), shall be used to determine compliance through December 31, 2001.

Questions

Questions about the new *2001 Energy Efficiency Standards for Residential and Nonresidential Buildings* or the *2001 Residential Energy Conservation Manual Supplement* can be addressed to the Commission's Energy Standards **Hotline at (916) 654-5106 or (800) 772-3300.**

Summary of Changes to the 1998 Standards

Part 1, Administrative Requirements

- ***Section 10-102*** - Administrative Definitions, Alternative Calculation Method (ACM)
- ***Section 10-109(b)2.*** - Calculation Methods
- ***Section 10-111*** - NFRC 100 updated
- ***Section 10-113*** **(New Section)** - Cool Roof Rating Council

Summary of Changes to the 1998 Standards (Continued)

Part 6, Standards Requirements

- ***Section 101(b)*** - Definitions
- ***Section 116*** - Fenestration Solar Heat Gain Coefficient Default Table
- ***Section 150(m)1.-3.*** - Mandatory Duct Construction
- ***Section 151(c)*** - Multiple Orientation Alternative
- ***Section 151(e)6.*** - Interior shading devices
- ***Section 151(f)*** - References to deleting of Prescriptive Packages A & B
- ***Section 151(f)2*** – **(New Section)** Radiant Barrier
- ***Section 151(f)7*** – Space heating and space cooling **(Thermostatic Expansion Valves)**
- ***Section 151(f)10*** – **(New Section)** Space conditioning ducts **(Duct Sealing)**
- ***Tables 1-Z1 through 1-Z16*** – Alternative Component Packages for Climate Zones 1-16
- ***Section 152(a)*** - Fenestration in Small Additions – Prescriptive Approach
- ***Section 152(b)1*** - Fenestration Alterations

Economic Summary

The Energy Commission is required by law to develop and maintain energy efficiency standards that are "cost effective, when taken in their entirety, and when amortized over the economic life of the structure when compared with historic practice.[1]" The 2001 Energy Efficiency Standards were shown to be extremely cost effective.

[1] Warren Alquist Act, Section 25402.

Summary of Changes to Each Section

Part 1, Administrative Requirements

Section 10-102 - Administrative Definitions, Alternative Calculation Method (ACM)

ALTERNATIVE CALCULATION METHOD APPROVAL MANUAL or ACM MANUAL for low-rise residential buildings is the Alternative Calculation Method (ACM) Approval Manual for the 2001 Energy Efficiency Standards for Residential Buildings (P400-00-026), for all single family and low-rise multi-family residential buildings. The 2001 ACM Manual includes the rules that vendors of compliance computer programs must follow for the 2001 Standards.

Section 10-109(b) 2. - Calculation Methods

This Section is updated to refer compliance computer program vendors to the new ACM.

Section 10-111 – Certification And Labeling Of Fenestration Product U-Values, Solar Heat Gain Coefficient, And Air Leakage

Referenced procedures have been updated from the 1991 version of NFRC 100 to – *NFRC 100: Procedure for Determining Fenestration Product U-factors* (1997).

Section 10-113 **(New Section)** - Cool Roof Rating Council

Effective January 1, 2003, the Cool Roof Rating Council (CRRC) is designated as the supervisory entity responsible for administering the state's testing, certification, and labeling program for "cool roof" roofing products.

Cool Roofs

A "Cool Roof" is a roofing material with high solar reflectance and high emittance that reduces heat gain through the roof.

Cool roofs are a new compliance option in the performance approach for roofing materials with higher reflectance. Tile roofs with a solar reflectance of 0.40 or higher and other roofs with a solar reflectance of 0.70 or higher receive a

credit equal to the cooling credit for radiant barriers. A minimum emittance of 0.75 is required.

Effective January 1, 2003, all qualifying products must meet the Cool Roof Rating Council's testing, certification and labeling criteria described in Section 10-113. Prior to January 1, 2003, solar reflectance should be measured according to ASTM E1918-97 or ASTM E903-96, and emittance should be measured according to ASTM E408-71 (1996)e1.

Liquid applied roofing products must be applied at a minimum dry mil thickness of 20 mils and meet specific performance requirements of ASTM D6083-97.

Part 6, Standards Requirements

Section 101(b) – Definitions

Six new definitions are added: CMC, Cool Roof, Duct Sealing, Radiant Barrier, Thermostatic Expansion Valve and U-factor.

Section 116 - Fenestration Solar Heat Gain Coefficient Default Table

In Table 1-E, the word "uncoated" is changed to "clear" to clarify the glazing type for fenestration products and corresponding default solar heat gain coefficients.

Section 150(m) - Mandatory Duct Construction

The use of building cavities as ducts is no longer allowed; ducts must be installed. The use of cloth-backed rubber adhesive duct tape is no longer allowed unless used in combination with mastic and drawbands. This disallowance of duct tape and building cavities as ducts extends the current criteria for duct credits to the mandatory requirements. Mechanical fastening of duct connections is required.

Section 151(c) - Multiple Orientation Alternative

Under performance compliance, a permit applicant may demonstrate compliance with the energy budget requirements of Section 151 (a) and (b) for any orientation of the same building model if the documentation demonstrates that the building model with its proposed designs and features complies in each of the four cardinal orientations.

The change to this section is that models may no longer differ in their shading. This means that designers may no longer move shading devices for compliance credit on to different orientations when using the multiple orientation option.

Section 151(e)6. - Interior shading devices

Compliance credit for interior shading (such as roller shades and mini-blinds) has been eliminated.

Section 151(f) - Deletion of Prescriptive Packages A and B

Alternative Component Packages A and B and Standards language associated with these packages have been deleted from the Standards, and are no longer compliance alternatives. The sections on "Continuous infiltration barrier" and "Air-to-air heat exchangers" have been eliminated because they only applied to Packages A and B.

Section 151(f)2 - Radiant Barriers

Radiant barriers are required in specified climate zones as part of Package D. The Bureau of Home Furnishings certifies radiant barrier products, which must have an emittance of 0.05 or less. Full installation requirements are described in Section 8.13 of the 1999 Energy Conservation Manual (P400-98-002).

Section 151(f)7 - Space heating and space cooling **(Thermostatic Expansion Valves)**

Thermostatic expansion valves (TXVs) or an equivalent alternative approved by the Commission are required for split system central air conditioners in specified climate zones as part of Package D. TXVs require field verification

(visual confirmation) by a certified HERS rater (see the Alternative to duct sealing, TXVs and field verification section on the next page).

Section 151(f)10 – **(New Section)** Space conditioning ducts **(Duct Sealing)**

The following is new Standards language from Section 151(f)10:

"All supply ducts must either be in conditioned space or be insulated to a minimum installed level of R-4.2 and constructed to meet minimum mandatory requirements of Section 150(m)."

"All duct systems shall be sealed, as confirmed through field verification and diagnostic testing in accordance with procedures set forth in the ACM Manual."

In the prescriptive compliance approach for Packages C & D, and to obtain compliance credit for sealed ducts in the performance approach, all duct systems must be sealed and duct leakage of less than 6% must be confirmed through field verification and diagnostic testing in accordance with procedures set forth in the ACM. This requirement applies to all climate zones for the prescriptive approach. (See the Alternative to duct sealing, TXVs and field verification section on the next page.)

The Energy Commission requires independent field verification of duct sealing and has designated HERS raters as the verification entity (See Chapter 7 of the ACM and Chapter 4 of the 1998 *Residential Manual).*

The following paragraphs summarize the responsibilities of the parties involved with regard to testing and inspecting for Duct Sealing.

Builders

Builders contract with an approved HERS rater who provides the builder with inspection, and diagnostic testing. The HERS rater also completes and provides *Certificate of Field Verification and Diagnostic Testing* (CF-4R) forms to the builder for submittal to the building department, and, if necessary, notifies the builder of corrective action needed to insure that homes comply.

Installers

Installers complete diagnostic testing required for compliance credit for each house, and certify testing results and that the work meets the requirements for compliance credit on the *Installation Certificate,* CF-6R. Installers work is then subject to field verification by approved HERS raters.

HERS Raters

Approved HERS raters conduct the field verification diagnostic testing and inspections, and provide *Certificate of Field Verification and Diagnostic Testing* (CF-4R) forms or notification that corrective actions are needed. HERS raters must be independent of both the builder and sub-contractor who installed the duct systems being field verified, and can have no financial interest in making corrections to the systems. As special inspectors HERS raters can not be employed by sub-contractors or parties, other than the builder, whose work they are evaluating.

Building Departments

Building departments consider approved HERS raters to be special inspectors. HERS raters must demonstrate competence, to the satisfaction of the building official, for the visual inspections and diagnostic testing. The building department, at its discretion, may require field verification testing and inspection to be conducted in conjunction with the building department's required inspections, and/or observe installer diagnostic testing and HERS rater verification in conjunction with the building department's required inspections to corroborate the results documented in installer certifications, and in the *Certificate of Field Verification and Diagnostic Testing* (CF-4R).

Alternative to duct sealing, TXVs and field verification

Under prescriptive compliance in lieu of duct sealing and TXV requirements, which require HERS rater field verification, the builder may choose a set of alternative features. If the builder chooses the alternative features, the builder must install fenestration and cooling systems, or in some climate zones heating systems, that are more energy efficient than the standard Package features (See below Table-1SP, Alternative Package Features).

Procedures for field verification

Procedures for the required field verification are specified in Chapter 4 of the 1999 *Residential Manual* and in the *Alternative Calculation Method Approval Manual* (ACM). Two primary changes to these requirements should be noted:

- in subdivisions, one out of seven homes built in sequence must be tested (previously one of every seven of each *model* were required to be tested);
- the duct requirements are now extended to multi-family projects.

Tables 1-Z1 through 1-Z16 – Alternative Component Packages for Climate Zones 1-16

For Prescriptive Compliance, Alternative Component Packages for Climate Zones 1-16, Packages A & B have been eliminated.

Package D has been modified to require Duct Sealing, and in some climate zones fenestration with 0.40 Solar Heat Gain Coefficient (SHGC) on all orientations and 0.65 U-Factors, TXV's, (or an equivalent alternative approved by the Commission) and/or Radiant Barriers. Other features of Package D can be determined by reviewing the Alternative Component Packages for Climate Zones 1-16 in the Standards.

See also Table 1 SUMMARY OF MAJOR CHANGES TO PACKAGE D on the next page.

Section 152(a) Fenestration in Small Additions - Prescriptive approach

In the 1998 Standards, additions up to 100 square feet were not allowed to have more than 50 square feet of glazing and the glazing U-value could not exceed 0.75.

The 2001 Standards include the above requirements and also require that the fenestration SHGC not exceed the value specified in Alternative Component Package D [Tables 1-Z1 through 1-Z16.

Section 152(b)1 Fenestration Alterations

The previous Standards required that any new fenestration added to a dwelling unit have a U-value of not more than 0.75.

The 2001 Standards require the 0.75 U-value plus the new fenestration must have an SHGC as specified in Alternative Component Package D [Tables 1-Z1 through 1-Z16.

Fenestration products that are a replacement or repair need not comply with either the U-value or the SHGC requirement.

1999 Residential Energy Conservation Manual (Form changes)

Appendix A – Compliance Forms

See the attached supplements to the CF - 1R, CF-4R and the CF-6R, MF-1R, and Form S. Note that these forms are supplemental to the 1999 *RESIDENTIAL MANUAL* and that the balance of the 1999 Forms remain in effect for the 2001 Standards except as otherwise noted in the 2001 Standards or this Manual Supplement.

TABLE 1	SUMMARY OF MAJOR CHANGES TO PACKAGE D (Alternative Component Packages - Tables 1-Z1 through 1-Z16)								
	Basic Prescriptive Package D					Alternative Package Features (See Note Below)			
Climate Zone	Window SHGC	Roof	Window U-Factor	Duct	TXV	Window SHGC	Window/ U-Factor	SEER	Heating
1	-	-	0.65	Sealed	-	-	0.55	-	AFUE 90/7.6HSPF
2	0.40	RB	0.65	Sealed	TXV	0.35	0.40	-	-
3	-	-	0.75	Sealed	-	-	0.55	-	-
4	0.40	RB	0.75	Sealed	-	0.35	0.40	-	-
5	-	-	0.75	Sealed	-	-	0.55	-	-
6	-	-	0.75	Sealed	-	-	0.55	-	-
7	0.40	-	0.75	Sealed	-	0.35	0.40	-	-
8	0.40	RB	0.75	Sealed	TXV	0.35	0.40	-	-
9	0.40	RB	0.75	Sealed	TXV	0.35	0.40	11	-
10	0.40	RB	0.65	Sealed	TXV	0.35	0.40	11	-
11	0.40	RB	0.65	Sealed	TXV	0.35	0.40	11	-
12	0.40	RB	0.65	Sealed	TXV	0.35	0.40	11	-
13	0.40	RB	0.65	Sealed	TXV	0.35	0.40	12	-
14	0.40	RB	0.65	Sealed	TXV	0.30	0.40	12	-
15	0.40	RB	0.65	Sealed	TXV	0.30	0.40	13	-
16	-	-	0.60	Sealed	-	-	0.55	-	AFUE 90/7.6HSPF

Note: The Alternative Package Features are intended to provide a different prescriptive means to meet the energy savings and demand reduction of the Basic Prescriptive Package D excluding Duct Sealing and TXVs (all other requirements of Package D must be met). This provides a prescriptive approach that does not require HERS rater field verification.

Definitions: CTZ = California Climate Zone
RB = Radiant Barrier at roof
Sealed = Ducts to have less than 6% leakage (must be field verified by HERS Rater)
TXV = Thermostatic Expansion Valve or an equivalent alternative approved by the Commission installed in split system Air Conditioner (must be field verified by HERS Rater)
SEER = Air Conditioner Seasonal Energy Efficiency Ratio
SHGC = Window Solar Heat Gain Coefficient
U-Factor = U-Value
AFUE = Furnace Annual Fuel Utilization Efficiency
- = No Change from 98 Standards

Other Package D Measures:

See *2001 AB 970 Energy Efficiency Standards for Residential and Nonresidential Buildings* (Alternative Component Packages, Tables 1-Z1 through 1-Z16 for all other required features, devices and systems for Package D.

CERTIFICATE OF COMPLIANCE: RESIDENTIAL (Page 1 of 3) CF-1R

Project Title

Date

Project Address

Building Permit #

Documentation Author Telephone

Plan Check / Date

Compliance Method (Package or Computer) Climate Zone

Field Check / Date

Enforcement Agency Use Only

GENERAL INFORMATION

Total Conditioned Floor Area _____ ft^2 Average Ceiling Height: _____ ft

Conditioned Slab Floor Area _____ ft^2

Building Type: _____ Single Family _____ Addition

(check one or more) _____ Multi-Family _____ Existing-Plus-Addition

Front Orientation: _____ North / South / East / West / All Orientations

(input front orientation in degrees from True North and circle one)

Number of Stories _____

Number of Dwelling Units: _____

Floor Construction Type: Slab/Raised Floor (circle one or both)

RADIANT BARRIER (required in climate zones 2, 4, 8-15) Required for this submittal___ yes ___no

BUILDING ENVELOPE INSULATION

Component Type	Frame Type wd = wood stl = steel	Cavity Insulation R-Value	Sheathing Insulation R-Value	Total R-Value[1]	Assembly U-Factor[1]	Location/Comments (attic, garage, typical, etc.)
Wall						
Wall						
Roof						
Roof						
Floor						
Floor						
Slab Edge						

[1] For prescriptive compliance, Total R-Value and Assembly U-Factor are not required for a wood-framed wall that meets cavity R-value insulation requirements for the Prescriptive Package.

FENESTRATION

Shading Devices

Fenestration #/Type/Pos.	Orien-tation	Area (ft^2)	Fenestration U-Factor	Fenestration SHGC	Exterior Shading Att.	Overhangs/ Fins
Front						
Front						
Left						
Left						
Rear						
Rear						
Right						
Right						
Skylight						
Skylight						

Project Title | Date

HVAC SYSTEMS

Note: Input hydronic or combined hydronic data under Water Heating Systems, except Design Heating Load.

Heating Equipment Type (furnace, heat pump, etc.)	Minimum Efficiency (AFUE or HSPF)	Distribution Type and Location (ducts, attic, etc.)	Duct or Piping R-Value	Thermostat Type	Heat Pump Configuration (split or package)

Cooling Equipment Type (air conditioner, heat pump, evap. cooling)	Minimum Efficiency (SEER)	Duct Location (attic, etc.)	Duct R-Value	Thermostat Type	Heat Pump Configuration (split or package)

SEALED DUCTS and TXVs (or Alternative Measures)

☐ Sealed Ducts (all climate zones)
(Installer testing and certification and HERS rater field verification required)

☐ TXVs or Commission approved equivalent, readily accessible (climate zones 2 and 8-15 only)
(Installer testing and certification and HERS Rater or field verification required)

OR

☐ Alternative to Sealed Ducts and TXVs (see Package C or D Alternative Package Features for Project Climate Zone)

Climate Zone	Window SHGC	Window U-Factor	SEER	Heating

WATER HEATING SYSTEMS

Water Heater Type	Distribution Type	Number in System	Rated[1] Input (kW or Btu/hr)	Tank Capacity (gallons)	Energy[1] Factor or Recovery Efficiency	Standby[1] Loss (%)	External Tank Insulation R-Value

1. For small gas storage water heaters (rated inputs of less than or equal to 75,000 Btu/hr), electric resistance, and heat pump water heaters, list Energy Factor. For large gas storage water heaters (rated input of greater than 75,000 Btu/hr), list Rated Input, Recovery Efficiency and Standby Loss. For instantaneous gas water heaters, list rated input and recovery efficiencies.

SPECIAL FEATURES (add extra sheets if necessary). **Package C and D: TXVs or Commission approved equivalent, Sealed Ducts, Radiant Barriers** (see installation requirements for radiant barriers in Section 8.13 of the 1999 Residential Manual). **Package C: thermal mass** (thermal mass type, covering, thickness, and description).

COMPLIANCE STATEMENT

This certificate of compliance lists the building features and performance specifications needed to comply with Title 24, Parts 1 and 6 of the California Code of Regulations, and the administrative regulations to implement them. This certificate has been signed by the individual with overall design responsibility. The undersigned recognize that compliance using duct sealing and TXVs (or Commission approved equivalent) requires installer testing and certification and field verification by an approved HERS rater.

Designer or Owner (per Business and Professions Code)

Name: _____

Title/Firm: _____

Address: _____

_____

Telephone: _____

Lic. #: _____

_____
(signature) (date)

Documentation Author

Name: _____

Title/Firm: _____

Address: _____

_____

Telephone: _____

_____
(signature) (date)

Enforcement Agency

Name: _____

Title: _____

Agency: _____

Telephone: _____

_____
(signature / stamp) (date)

Project Title		Date	
Project Address		Builder Name	
Builder Contact	Telephone	Plan Number	
HERS Rater	Telephone	Sample Group Number	
Certifying Signature	Date	Sample House Number	

Firm:_____ HERS Provider: _____

Street Address: _____ City/State/Zip: _____

Copies to: Builder, HERS Provider

HERS RATER COMPLIANCE STATEMENT

The house was: ☐ Tested ☐ Approved as part of sample testing, but was not tested

As the HERS rater providing diagnostic testing and field verification, I certify that the houses identified on this form comply with the diagnostic tested compliance requirements as checked on this form.

- ☐ Distribution system is fully ducted (i.e., does not use building cavities as plenums or platform returns in lieu of ducts)
- ☐ Where cloth backed, rubber adhesive duct tape is installed, mastic and drawbands are used in combination with cloth backed, rubber adhesive duct tape to seal leaks at duct connections.

☐ MINIMUM REQUIREMENTS FOR DUCT LEAKAGE REDUCTION COMPLIANCE CREDIT

Duct Diagnostic Leakage Testing Results (Maximum 6% Duct Leakage)

Duct Pressurization Test Results (CFM @ 25 Pa)	Measured values	
Test Leakage Flow in CFM	_____	
If fan flow is calculated as 400cfm/ton x number of tons enter calculated value here	_____	
If fan flow is measured enter measured value here	_____	
Leakage Percentage (100 x Test Leakage/Fan Flow) =	_____	
Check Box for Pass or Fail (Pass=6% or less)		☐ Pass ☐ Fail

☐ THERMOSTATIC EXPANSION VALVE (TXV) or Commission approved equivalent

☐ Yes ☐ No Thermostatic Expansion Valve (or Commission approved equivalent) is installed and Access is provided for inspection

Yes is a pass ☐ Pass ☐ Fail

☐ MINIMUM REQUIREMENTS FOR DUCT DESIGN COMPLIANCE CREDIT

1. ☐ Yes ☐ No ACCA Manual D Design requirements have been met (rater has verified that actual installation matches values in CF-1R and design on plan.

2. ☐ Yes ☐ No TXV is installed or Fan flow has been verified. If no TXV, verified fan flow matches design from CF-1R.
   Measured Fan Flow = _____

Yes for both 1 and 2 is a Pass ☐ Pass ☐ Fail

Project Title _____ Plan Number _____ Date _____

Sample Group Number _____ Sample House Number _____

☐ **MINIMUM REQUIREMENTS FOR DUCT IN CONDITIONED SPACE COMPLIANCE CREDIT**

Field Verification Results

☐ Yes ☐ No Duct in conditioned space criteria matches CF-1R

Yes is a Pass ☐ Pass ☐ Fail

☐ **MINIMUM REQUIREMENTS FOR REDUCED DUCT SURFACE AREA COMPLIANCE CREDIT**

Measured duct exterior surface area in the following unconditioned duct locations (square feet):

Attics _____

Crawlspaces _____

Basements _____

Other (e.g., garages, etc.) _____

☐ Yes ☐ No Duct surface area matches CF-1R?

Yes is a Pass ☐ Pass ☐ Fail

Project Title _____ Plan Number _____ Date _____

Sample Group Number _____ Sample House Number _____

☐ **MINIMUM REQUIREMENTS FOR INFILTRATION REDUCTION COMPLIANCE CREDIT**

Diagnostic Testing Results

Building Envelope Leakage (CFM @ 50 Pa) as measured by Rater _____

1.	☐ Yes	☐ No	Is measured envelope leakage less than or equal to the required level from CF-1R?
2.	☐ Yes	☐ No	Is Mechanical Ventilation shown as required on the CF-1R?
2a.	☐ Yes	☐ No	If Mechanical Ventilation is required on the CF-1R (Yes in line 2), has it been installed?
2b.	☐ Yes	☐ No	Check this box yes if mechanical ventilation is required (Yes in line 2) and ventilation fan watts are no greater than shown on CF-1R.
3.	☐ Yes	☐ No	Check this box yes if measured building infiltration (CFM @ 50 Pa) is greater than the CFM @ 50 values shown for an SLA of 1.5 on CF-1R (If this box is checked no, mechanical ventilation is required.)
4.	☐ Yes	☐ No	Check this box yes if measured building infiltration (CFM @ 50 Pa) is less than the CFM @ 50 values shown for an SLA of 1.5 on CF-1R, mechanical ventilation is installed and house pressure is greater than minus 5 Pascal with all exhaust fans operating.

☐ Pass ☐ Fail

Pass if:

a. Yes in line 1 and line 3, or
b. Yes in line 1 and line2, 2a, and 2b, or
c. Yes in line 1 and Yes in line 4.

Otherwise fail.

INSTALLATION CERTIFICATE (Page 1 of 8) CF-6R

Site Address **Permit Number**

An installation certificate is required to be posted at the building site or made available for all appropriate inspections. (The information provided on this form is required; however, use of this form to provide the information is optional.) After completion of final inspection, a copy must be provided to the building department (upon request) and the building owner at occupancy, per Section 10-103(b).

HVAC SYSTEMS:

Heating Equipment

Equip. Type (pkg. heat pump)	CEC Certified Mfr Name and Model Number	# of Identical Systems	Efficiency (AFUE, etc.)[1] [≥CF-1R value]	Duct Location (attic, etc.)	Duct or Piping R-value	Heating Load (Btu/hr)	Heating Capacity (Btu/hr)

Cooling Equipment

Equip. Type (pkg. heat pump)	CEC Certified Compressor Unit Mfr Name and Model Number	# of Identical Systems	Efficiency (SEER, etc.)[1] [≥CF-1R value]	Duct Location (attic, etc.)	Duct R-value	Cooling Load (Btu/hr)	Cooling Capacity (Btu/hr)

1. ≥ reads *greater than or equal to.*

I, the undersigned, verify that equipment listed above is: 1) is the actual equipment installed, 2) equivalent to or more efficient than that specified in the certificate of compliance (Form CF-1R) submitted for compliance with the *Energy Efficiency Standards* for residential buildings, and 3) equipment that meets or exceeds the appropriate requirements for manufactured devices (from the *Appliance Efficiency Regulations* or Part 6), where applicable.

Signature, Date

Installing Subcontractor (Co. Name)
OR General Contractor (Co. Name) OR Owner

WATER HEATING SYSTEMS:

Heater Type	CEC Certified Mfr Name & Model Number	Distribution Type (Std, Point-of-Use)	If Recir-culation, Control Type	# of Identical Systems	Rated[2] Input (kW or Btu/hr)	Tank Volume (gallons)	Effi-ciency[2] (EF, RE)	Standby[2] Loss (%)	External Insulation R-value[3]

2 For **small gas storage** (rated input of less than or equal to 75,000 Btu/hr), **electric resistance** and **heat pump water heaters**, list Energy Factor.
For **large gas storage water heaters** (rated input of greater than 75,000 Btu/hr), list Recovery Efficiency, Standby Loss and Rated Input.
For **instantaneous gas water heaters**, list Recovery Efficiency and Rated Input.

3. R-12 external insulation is mandatory for storage water heaters with an energy factor of less than 0.58.

Faucets & Shower Heads:

All faucets and showerheads installed are certified to the Commission, pursuant to Title 24, Part 6, Section 111.

I, the undersigned, verify that equipment listed above my signature is: 1) the actual equipment installed; 2) equivalent to or more efficient than that specified in the certificate of compliance (Form CF-1R) submitted for compliance with the *Energy Efficiency Standards* for residential buildings; and 3) equipment that meets or exceeds the appropriate requirements for manufactured devices (from the *Appliance Efficiency Regulations* or Part 6), where applicable.

Signature, Date

Installing Subcontractor (Co. Name) OR
General Contractor (Co. Name) OR Owner

COPY TO: Building Department
HERS Provider (if applicable)
Building Owner at Occupancy

Site Address **Permit Number**

FENESTRATION/GLAZING:

Manufacturer/Brand Name (GROUP LIKE PRODUCTS)	Product U-Factor[1] (≤ CF-1R value)[2]	Product SHGC[1] (≤ CF-1R value)[2]	# of Panes	Total Quantity of Like Product (*Optional*)	Square Feet	Exterior Shading Device or Overhang	Comments/Location/ Special Features
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							

[1] Manufactured fenestration products use the values from the product label. Field fabricated fenestration products use the default values from Section 116 of the Energy Efficiency Standards.

[2] Installed U-Factor must be less than or equal to values from CF-1R. Installed SHGC must be less than or equal to values from CF-1R, or a shading device (exterior or overhang) is installed as specified on the CF-1R. Alternatively, installed weighted average U-Factors for the total fenestration area are less than or equal to values from CF-1R.

I, the undersigned, verify that the fenestration/glazing listed above my signature: 1) is the actual fenestration product installed; 2) is equivalent to or has a lower U-Factor and lower SHGC than that specified in the certificate of compliance (Form CF-1R) submitted for compliance with the *Energy Efficiency Standards* for residential buildings; and 3) the product meets or exceeds the appropriate requirements for manufactured devices (from Part 6), where applicable.

Item #s (if applicable)	Signature, Date	Installing Subcontractor (Co. Name) OR General Contractor (Co. Name) OR Owner OR Window Distributor
Item #s (if applicable)	Signature, Date	Installing Subcontractor (Co. Name) OR General Contractor (Co. Name) OR Owner OR Window Distributor
Item #s (if applicable)	Signature, Date	Installing Subcontractor (Co. Name) OR General Contractor (Co. Name) OR Owner OR Window Distributor

COPY TO: Building Department
HERS Provider (if applicable)
Building Owner at Occupancy

Site Address **Permit Number**

DUCT LEAKAGE AND DESIGN DIAGNOSTICS

☐ DUCT LEAKAGE REDUCTION

Pressurization Test Results (CFM @ 25 PA)

Test Leakage (CFM) _____

Fan Flow

If Fan Flow is Calculated as 400 cfm/ton x number of tons, or as 21.7 x Heating Capacity in Thousands of Btu/hr, enter calculated value here _____

If fan flow is measured, enter measured value here _____

Leakage Fraction = Test Leakage/(Measured or Calculated Fan Flow) = _____

Pass if leakage fraction ≤ 0.06 ☐ Pass ☐ Fail

☐ **For AEROSOL TYPE SEALANTS ONLY - The following diagnostic testing was completed:**

Duct Fan Pressurization at rough-in measured leakage (CFM)

CHECK AFTER FINISHING WALL:

☐ Yes ☐ No ☐ Pressure pan test or House pressurization test

☐ Yes ☐ No ☐ Visual Inspection of Duct Connections ☐ Pass ☐ Fail

☐ THERMOSTATIC EXPANSION VALVE (TXV)

☐ Yes ☐ No Thermostatic Expansion Valve (or Commission approved equivalent) is installed and Access is provided for inspection

Yes is a pass ☐ Pass ☐ Fail

☐ DUCT DESIGN

1. ☐ Yes ☐ No ACCA Manual D Design calculations have been completed, Duct Design is on the plans and duct installation matches plans.

2. ☐ Yes ☐ No TXV is installed or Fan flow has been verified. If no TXV, verified fan flow matches design from CF-1R.

Measured Fan Flow = _____

Yes for both 1 and 2 is a Pass ☐ Pass ☐ Fail

☐ I, the undersigned, verify that the above diagnostic test results and the work I performed associated with the test(s) is in conformance with the requirements for compliance credit. [The builder shall provide the HERS provider a copy of the CF-6R signed by the builder employees or sub-contractors certifying that diagnostic testing and installation meet the requirements for compliance credit.]

Tests Performed

Signature, Date

Installing Subcontractor (Co. Name) OR General Contractor (Co. Name)

COPY TO: Building Department
HERS Provider (if applicable)
Building Owner at Occupancy

Site Address **Permit Number**

DUCT LOCATION AND AREA REDUCTION DIAGNOSTICS

☐ **DUCT IN CONDITIONED SPACE**

☐ Yes ☐ No Duct in conditioned space criteria matches CF-1R

	Yes is a Pass	Pass	Fail
		☐	☐

☐ **REDUCED DUCT SURFACE AREA**

Measured duct exterior surface area in the following unconditioned duct locations (square feet):

Attics _____

Crawlspaces _____

Basements _____

Other (e.g., garages, etc.) _____

☐ Yes ☐ No Duct surface area matches CF-1R?

	Yes is a Pass	Pass	Fail
		☐	☐

☐ I, the undersigned, verify that the duct surface area and duct locations claimed for duct surface area reductions and duct location improvements beyond those covered by default assumptions match those on the plans. [The builder shall provide the HERS provider a copy of the CF-6R signed by the builder employees or sub-contractors certifying that diagnostic testing and installation meet the requirements for compliance credit.]

Tests Performed	Signature, Date	Installing Subcontractor (Co. Name) OR General Contractor (Co. Name)

COPY TO: Building Department
HERS Provider (if applicable)
Building Owner at Occupancy

Site Address **Permit Number**

BUILDING ENVELOPE LEAKAGE DIAGNOSTICS

☐ **ENVELOPE SEALING INFILTRATION REDUCTION**

Diagnostic Testing Results

Building Envelope Leakage (CFM @ 50 Pa) as measured by Rater _____

1.	☐ Yes	☐ No	Is measured envelope leakage less than or equal to the required level from CF-1R?
2.	☐ Yes	☐ No	Is Mechanical Ventilation shown as required on the CF-1R?
2a.	☐ Yes	☐ No	If Mechanical Ventilation is required on the CF-1R (Yes in line 2), has it been installed?
2b.	☐ Yes	☐ No	Check this box yes if mechanical ventilation is required (Yes in line 2) and ventilation fan watts are no greater than shown on CF-1R. Measured Watts = _____
3.	☐ Yes	☐ No	Check this box yes if measured building infiltration (CFM @ 50 Pa) is greater than the CFM @ 50 values shown for an SLA of 1.5 on CF-1R (If this box is checked no, mechanical ventilation is required.)
4.	☐ Yes	☐ No	Check this box yes if measured building infiltration (CFM @ 50 Pa) is less than the CFM @ 50 values shown for an SLA of 1.5 on CF-1R, mechanical ventilation is installed and house pressure is greater than minus 5 Pascal with all exhaust fans operating.

☐ Pass ☐ Fail

Pass if:
a. Yes in line 1 and line 3, or
b. Yes in line 1 and line2, 2a, and 2b, or
c. Yes in line 1 and Yes in line 4.

Otherwise fail.

☐ I, the undersigned, verify that the building envelope leakage meets the requirements claimed for building leakage reduction below default assumptions as used for compliance on the CF-1R. This is to certify that the above diagnostic test results and the work I performed associated with the test(s) is in conformance with the requirements for compliance credit. [The builder shall provide the HERS provider a copy of the CF-6R signed by the builder employees or sub-contractors certifying that diagnostic testing and installation meet the requirements for compliance credit.]

Test Performed	Signature	Date	Testing Subcontractor (Co. Name) OR General Contractor (Co. Name)
_____	_____	_____	_____

COPY TO: Building Department
HERS Provider (if applicable)
Building Owner at Occupancy

Site Address **Permit Number**

The following is an explanation of many of the input values required on this form:

HVAC SYSTEMS

Heating Equipment Type must be one of the following:

Furnace:	Gas (including Liquefied Petroleum Gases) or oil-fired central furnace & space heater
Boiler:	Gas or oil-fired boiler
PckgHeatPump:	Packaged central heat pump
SplitHeatPump:	Split central heat pump
RoomHeatPump:	Room heat pump
LgPkgHeatPump:	Large packaged heat pump (≥ 65,000 Btu/hr output)
Electric:	Electric resistance heating (fixed HSPF = 3.413); radiant electric resistance (fixed HSPF = 3.55)
CombinedHydro:	Reference water heater under water heating systems below

CEC Certified Manufacturer Name & Model Number from applicable Commission approved appliance directory.
# of Identical Systems is for those systems with the same efficiency, duct location, duct R-value and capacity.
Efficiency from applicable Commission certified appliance directory.
Duct (or Piping) Location is attic, crawl space, CVC crawl space, conditioned space, unconditioned space or none.
Duct (or Piping) R-Value from Directory of Certified Insulation Materials and/or manufacturer's data.
Heating/Cooling Load refer to Commission approved load calculation procedure.
Heating/Cooling Capacity from the applicable Commission certified appliance directory. Note: location elevations over 2,000 ft above sea level require a derating of output capacity (refer to manufacturer's literature).

Cooling Equipment Type must be one of the following:

SplitAirCond:	Split system air conditioner
PckgAirCond:	Packaged air conditioner
Split Heat Pump:	Split system heat pump
PckgHeatPump:	Packaged heat pump
RoomHeatPump:	Room heat pump
LgPkgHeatPump:	Large packaged heat pump (≥ 65,000 Btu/hr output). Substitute EER for SEER when SEER is not available
RoomAirCond:	Room air conditioner. Minimum SEER varies*
LgPkgAirCond:	Large packaged air conditioner (≥ 65,000 Btu/hr output). Substitute EER for SEER when SEER is not available
EvapDirect:	Direct evaporative cooling system. For compliance calculation purposes, fixed values: SEER = 11.0; duct location = attic; duct insulation R-value = 4.2
EvapIndirect:	Indirect evaporative cooling system. For compliance calculation purposes, fixed values: SEER = 13.0; duct location = attic; duct insulation R-value = 4.2

*Refer to Energy Commission publication *Appliance Efficiency Regulations*, P400-92-029

Site Address **Permit Number**

The following is an explanation of many of the input values required on this form:

WATER HEATING SYSTEMS

Distribution Systems Refer to *Residential Manual* for more details:

Standard:	Standard – Supply pressure based system, no pumps
Pipe Insulation:	Pipe Insulation on all 3/4-inch pipes
POU/HWR:	Point of Use/Hot Water Recovery System
Recirc/NoControl:	Recirculation loop with no controls
Recirc/Timer:	Recirculation loop with a timer
Recirc/Temp:	Recirculation loop with temperature control
Recirc/Time+Temp:	Recirculation loop with a timer and temperature control
Recirc/Demand:	Recirculation loop with demand control

Water Heater Type	Information Needed			
	Energy Factor	Recovery Efficiency	Standby Loss	Rated Input
Storage Gas, Oil or Electric	Yes	No	No	No
Heat Pump	Yes	No	No	No
Instantaneous Gas	No	Yes	No	No
Instantaneous Electric	Yes	No	No	No
Large Storage Gas	No	Yes	Yes	Yes
Indirect Gas (Boiler)	No	Yes (AFUE)	No	Yes

FENESTRATION/GLAZING

Fenestration:	Windows, sliding glass doors, French doors, skylights, garden windows, and any door with more than one square foot of glass
Operator Type:	Slider, hinged, fixed
U-Factor:	Installed U-Factor must be less than or equal to value from CF-1R OR Installed weighted average U-Factor for the total fenestration area is less than or equal to value from CF-1R
SHGC:	Installed SHGC must be less than or equal to value from CF-1R OR Installed weighted SHGC for the total fenestration area is less than or equal to value from CF-1R OR An interior shading device, overhang, or exterior shading device is installed consistent with the CF-1R
Shading Device:	Include when the building complied using an ***exterior*** shading device: woven sunscreen, louvered sunscreen, low sun angle sunscreen, roll-down awning, roll-down blinds or slats (do not list bug screen), or an overhang (include depth in feet)

Site Address **Permit Number**

The following is an explanation of many of the input values required on the Diagnostic portion of this form (page 3 of 6):

TYPE OF CREDIT

Refer to *Residential Manual* Chapters 4 and 5 for more details:

Reduced Duct Surface Area:	Calculated as the outside area of the duct. Areas must be measured and verified by a HERS rater.
Improved Duct Location:	Supply duct located in other than attic, as verified by location of registers (does not require HERS rater verification).
Catastrophic Leakage:	Pressure pan test readings must be less than 1.5 Pascal at a house pressure of 25 Pascal.
TXV (or Commission approved equivalent):	Access cover required to facilitate verification. Eligibility criteria for Commission approved equivalent, if applicable, is required to be met.
Infiltration Reduction:	Infiltration is measured without mechanical ventilation operating. Mechanical ventilation is required for very tight house construction when credits for infiltration reduction using diagnostic testing are being used for achieving compliance. These very tight houses are defined as those with SLA of less than 1.5. The compliance documentation (CF-1R) will contain the measured CFM target value from a blower door test at 50 Pascal pressure difference that represents this SLA of 1.5. Mechanical ventilation is also required if the builder chooses to design the building to use mechanical ventilation and claims a credit for infiltration below an SLA of 3.0. The compliance documentation (CF-1R) will contain the measured CFM target value that represents this 3.0 SLA. If the builder claims credit in a design for infiltration reduction that is at an SLA of 3.0 or higher, and the actual measured SLA is 1.5 or greater, then mechanical ventilation is not required. If the SLA in this case were below 1.5, then mitigation (such as mechanical ventilation) would be required.

MANDATORY MEASURES CHECKLIST: RESIDENTIAL (Page 1 of 2) MF-1R

Note: Lowrise residential buildings subject to the Standards must contain these measures regardless of the compliance approach used. Items marked with an asterisk (*) may be superseded by more stringent compliance requirements listed on the Certificate of Compliance. When this checklist is incorporated into the permit documents, the features noted shall be considered by all parties as minimum component performance specifications for the mandatory measures whether they are shown elsewhere in the documents or on this checklist only.

Instructions: Check or initial applicable boxes when completed or enter N/A if not applicable.

DESCRIPTION	DESIGNER	ENFORCEMENT
Building Envelope Measures:		
* §150(a): Minimum R-19 ceiling insulation.		
§150(b): Loose fill insulation manufacturer's labeled R-Value.		
* §150(c): Minimum R-13 wall insulation in wood framed walls or equivalent U-Factor in metal frame walls (does not apply to exterior mass walls).		
* §150(d): Minimum R-13 raised floor insulation in framed floors.		
§150(l) : Slab edge insulation - water absorption rate no greater than 0.3%, water vapor transmission rate no greater than 2.0 perm/inch.		
§118: Insulation specified or installed meets insulation quality standards. Indicate type and form.		
§116-17: Fenestration Products, Exterior Doors, and Infiltration/Exfiltration Controls 1. Doors and windows between conditioned and unconditioned spaces designed to limit air leakage. 2. Fenestration products (except field-fabricated) have label with certified U-Factor, certified Solar Heat Gain Coefficient (SHGC), and infiltration certification. 3. Exterior doors and windows weatherstripped; all joints and penetrations caulked and sealed.		
§150(g): Vapor barriers mandatory in Climate Zones 14 and 16 only.		
§150(f): Special infiltration barrier installed to comply with § 151 meets Commission quality standards.		
§150(e): Installation of Fireplaces, Decorative Gas Appliances and Gas Logs. 1. Masonry and factory-built fireplaces have: a. Closeable metal or glass door b. Outside air intake with damper and control c. Flue damper and control 2. No continuous burning gas pilot lights allowed.		
Space Conditioning, Water Heating and Plumbing System Measures:		
§110-§113: HVAC equipment, water heaters, showerheads and faucets certified by the Commission.		
§150(h): Heating and/or cooling loads calculated in accordance with ASHRAE, SMACNA or ACCA.		
§150(i): Setback thermostat on all applicable heating and/or cooling systems.		
§150(j): Pipe and tank insulation 1. Storage gas water heaters rated with an Energy Factor less than 0.58 must be externally wrapped with insulation having an installed thermal resistance of R-12 or greater. 2. First 5 feet of pipes closest to water heater tank, non-recirculating systems, insulated (R-4 or greater) 3. Back-up tanks for solar system, unfired storage tanks, or other indirect hot water tanks have R-12 external insulation or R-16 combined internal/external insulation. 4. All buried or exposed piping insulated in recirculating sections of hot water systems. 5. Cooling system piping below 55º F insulated. 6. Piping insulated between heating source and indirect hot water tank.		

MANDATORY MEASURES CHECKLIST: RESIDENTIAL (Page 2 of 2) MF-1R

Note: Lowrise residential buildings subject to the Standards must contain these measures regardless of the compliance approach used. Items marked with an asterisk (*) may be superseded by more stringent compliance requirements listed on the Certificate of Compliance. When this checklist is incorporated into the permit documents, the features noted shall be considered by all parties as minimum component performance specifications for the mandatory measures whether they are shown elsewhere in the documents or on this checklist only.

Instructions: Check or initial applicable boxes when completed or enter N/A if not applicable.

DESCRIPTION	DESIGNER	ENFORCEMENT
Space Conditioning, Water Heating and Plumbing System Measures: (continued)		
* §150(m): Ducts and Fans 1. All ducts and plenums installed, sealed and insulated to meet the requirement of the 1998 CMC Sections 601, 603, 604, and Standard 6-3; ducts insulated to a minimum installed level of R-4.2 or enclosed entirely in conditioned space. Openings shall be sealed with mastic, tape, aerosol sealant, or other duct-closure system that meets the applicable requirements of UL 181, UL 181A, or UL 181B. If mastic or tape is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape shall be used. Building cavities shall not be used for conveying conditioned air. Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands. 2. Exhaust fan systems have back draft or automatic dampers. 3. Gravity ventilating systems serving conditioned space have either automatic or readily accessible, manually operated dampers.		
§114: Pool and Spa Heating Systems and Equipment. 1. System is certified with 78% thermal efficiency, on-off switch, weatherproof operating instructions, no electric resistance heating and no pilot light. 2. System is installed with: a. At least 36” of pipe between filter and heater for future solar heating. b. Cover for outdoor pools or outdoor spas. 3. Pool system has directional inlets and a circulation pump time switch.		
§115: Gas fired central furnaces, pool heaters, spa heaters or household cooking appliances have no continuously burning pilot light. (Exception: Non-electrical cooking appliances with pilot < 150 Btu/hr)		
Lighting Measures:		
§150(k)1.: Luminaires for general lighting in kitchens shall have lamps with an efficacy of 40 lumens/watt or greater for general lighting in kitchens. This general lighting shall be controlled by a switch on a readily accessible lighting control panel at an entrance to the kitchen.		
§150(k)2.: Rooms with a shower or bathtub must have either at least one luminaire with lamps with an efficacy of 40 lumens/watt or greater switched at the entrance to the room or one of the alternatives to this requirement allowed in §150(k)2.; and recessed ceiling fixtures are IC (insulation cover) approved.		